Ordering number : EN4787A

Monolithic Linear IC



LA1836, 1836M



Single-Chip Home Stereo Electronic Tuning IC

Overview

AM: RF amplifier, mixer, oscillator (with ALC), IF amplifier, detector, AGC, oscillator buffer, tuning indicator (narrow-band SD), IF buffer output, IF output for AM stereo

- FM IF: IF amplifier, quadrature detector, band muting, tuning indicator, IF buffer output, S-meter
- MPX: PLL stereo decoder, stereo indicator, forced mono, VCO stop function, adjacent channel interference rejection function (114 kHz), post-amplifier (with muting function)

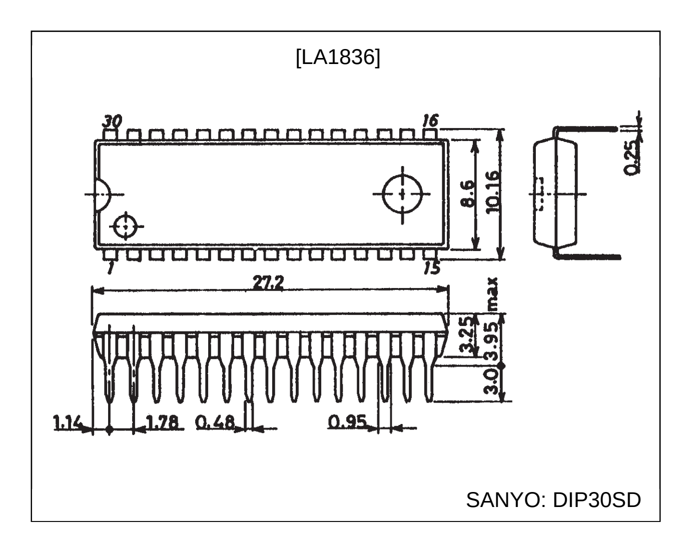
Features

- Reduced number of adjustments (adjustment-free MPX VCO: ceramic resonator adopted)
- Tuning indicator pin (Can be used as a narrow-band stop signal and as a muting output driver.)
- Variable FM stop sensitivity and band
- Variable AM stop sensitivity
- Built-in AM local oscillator buffer
- Variable AM low cut control

Package Dimensions

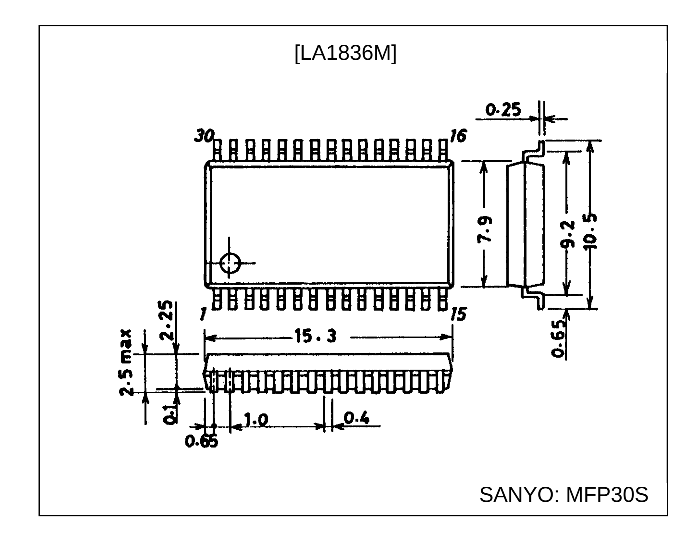
unit: mm

3196-DIP30SD



unit: mm

3073A-MFP30S



Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		9.0	V
Allowable power dissipation	Pd max	At Ta ≤ 70°C, on the recommended printed circuit board* [LA1836, LA1836M]	550	mW
		At Ta = 70°C, independent IC [LA1836M only]	320	mW
Operating temperature	Topr		–20 to +70	°C
Storage temperature	Tstg		–40 to +125	°C

Note: * An 85 × 115 × 1.6 mm^3 glass-epoxy printed circuit board.

Operating Conditions at Ta = 25°C

Parameter	Symbol	Ratings	Unit
Recommended supply voltage	V_{CC}	7.0	V
Operating supply voltage range	V_{CC} op	6.5 to 8.5	V

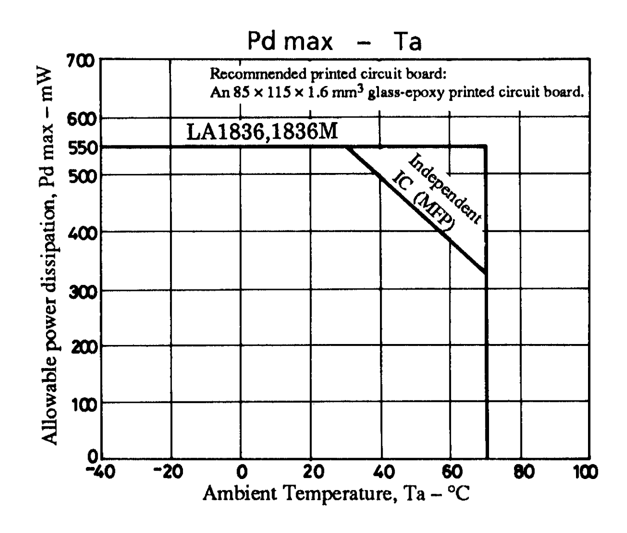
Electrical Characteristics at Ta = 25°C, V_{CC} = 7.0 V unless otherwise specified (MFP package using the Yamaichi Electric IC-51-0302-426MF socket)

Parameter	Symbol	Conditions	min	typ	max	Unit
[FM characteristics (mono): f_c = 10.7 MHz, f_m = 1 kHz, with the coil adjusted at V_{REG} – V_{AFC} = 0 V]						
Quiescent current	I_{CCO}-FM	No input		37	50	mA
Demodulator output	V_O-FM	100 dBμ, 100% mod, the pin 16 output	730	1100	1460	mVrms
Channel balance (mono)	C.B-mono	100 dBμ, 100% mod, the pin 16 output/pin 17 output	–1.5	0	+1.5	dB
Total harmonic distortion	THD-FM (1)	100 dBμ, 100% mod, the pin 16 output		0.3	1.3	%
	THD-FM (2)	100 dBμ, 200% mod, the pin 16 output		1.5	8.0	%
S/N ratio	S/N-FM	100 dBμ, 100% mod, the pin 16 output	72	80		dB
AM suppression ratio	AMR	100 dBμ, AM 30% mod, the pin 16 output	40	60		dB
Input limiting voltage	–3dBL.S.	100 dBμ, referenced to 100% mod, a 3 dB down input		34	42	dBμ
LED on sensitivity	SD-On-FM		46	56	66	dBμ
LED on bandwidth	SD-BW	100 dBμ	90	125	170	kHz
IF count buffer output	V_{IFBuff}-FM	100 dBμ, the pin 11 output	80	120	160	mVrms
S-meter output	V_{SM}-FM (1)	0 dBμ, the pin 12 output	0	0.5	1.0	V
	V_{SM}-FM (2)	60 dBμ, the pin 12 output	1.8	3.2	4.5	V
	V_{SM}-FM (3)	100 dBμ, the pin 12 output	3.5	4.2	5.0	V
Muting attenuation	Mute-Att	100 dBμ, 100% mod, the pin 16 output	80	95		dB
[FM characteristics (stereo): f_c = 10.7 MHz, f_m = 1 kHz, L + R = 90%, pilot = 10%, V_{IN} = 100 dBμ]						
Separation - L	Sep-L	L mod, the pin 17 output/pin 16 output	30	45		dB
Separation - R	Sep-R	R mod, the pin 16 output/pin 17 output	30	45		dB
Stereo on level	ST-on	The pilot modulation such that V7 < 0.7 V	1.8	3.6	6.0	%
Stereo off level	ST-off	The pilot modulation such that V7 > 4.5 V		2.5		%
Total harmonic distortion (main)	THD-main	The pin 16 output		0.3	1.3	%
Channel balance (main)	C.B-main	The pin 16 output/pin 17 output	–1.5	0	+1.5	dB
Capture range	C.R	Pilot = 10%		±1.5		%
Adjacent channel interference rejection ration	B.Rej.	fs = 113 kHz, Vs = 90%, pilot = 10%, the pin 16 output		40		dB

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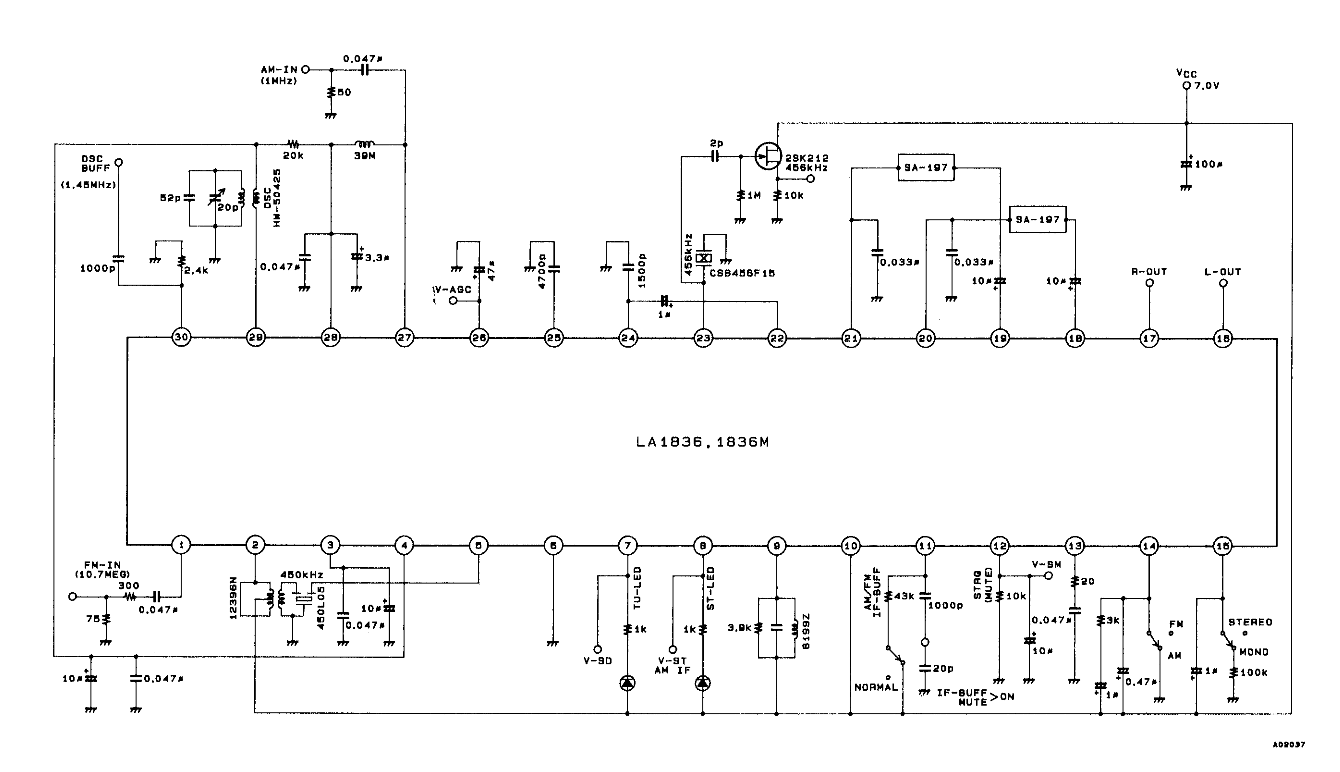
Parameter	Symbol	Conditions	min	typ	max	Unit
[AM characteristics: f_c = 1000 kHz, f_m = 1 kHz]						
Quiescent current	I_{CCO}-AM	No input		29	42	mA
Detector output	V_O-AM (1)	23 dBµ, 30% mod, the pin 16 output	25	45	90	mVrms
	V_O-AM (2)	80 dBµ, 30% mod, the pin 16 output	195	310	490	mVrms
S/N ratio	S/N-AM (1)	23 dBµ, 30% mod, the pin 16 output	16	20		dB
	S/N-AM (2)	80 dBµ, 30% mod, the pin 16 output	48	54		dB
Total harmonic distortion	THD-AM (1)	80 dBµ, 30% mod, the pin 16 output		0.3	1.0	%
	THD-AM (2)	100 dBµ, 30% mod, the pin 16 output (DIP)		0.4	1.2	%
	THD-AM (2)	107 dBµ, 30% mod, the pin 16 output (MFP)		0.8	1.6	%
	THD-AM (3)	80 dBµ, 80% mod, the pin 16 output		1.0	4.0	%
LED on sensitivity	SD-On-AM		20	30	40	dBµ
Local oscillator buffer output	V_{OSC}-AM	80 dBµ, 30% mod, the pin 16 output	110	160		mVrms
Low band attenuation	Low-Cut	Referenced to f_m = 1 kHz, the output when f_m = 100 Hz	5	7	11	dB
IF count buffer output	V_{IFBuff}-AM	80 dBµ, unmodulated, the pin 11 output	140	200	280	mVrms
ST-IF output	V_{STIF}-AM	80 dBµ, unmodulated, the pin 8 output	8	17	24	mVrms
S-meter output	V_{SM}-AM (1)	0 dBµ, unmodulated	0	0	0.2	V
	V_{SM}-AM (2)	40 dBµ, unmodulated	1.3	3.0	4.5	V



Block Diagram

Unit (resistance: Ω, capacitance: F)

Test Circuit Diagram



Unit (resistance: Ω, capacitance: F)

Pin Functions

Pin No.	Function	Voltage	Internal equivalent circuit	Remarks
1	FM IF input	V_{REG}	A01486	Input impedance r_i = 330 Ω
2	AM mixer output	V_{CC}	A01487	
3	FM IF input bypass	V_{REG}	A01486	Also used for the AM noise filter
4	REG	V_{REG}	A01488	V_{REG} = 3.6 V
5	AM IF input	V_{REG}	A01489	Input impedance r_i = 2 kΩ
6	GND	0 V		
7 8	Tu – LED ST – LED, AM – IF output	V_{CC} V_{CC}	A01490	Active low Open collector AM stereo IF output (pin 8)
9	FM detector	V_{CC}	A02039	Recommended detector coil: 600TEAS-8199Z (Toko) SA281 (Sumida)
10	V_{CC}	V_{CC}		
11	AM/FM IF buffer output, output control SW (muting switch)	0 V	A01492	The post-amplifier muting turns on for applied voltages of 1.3 V and over. The IF buffer output turns on at 4.0 V and over. Recommended muting on control voltage: 1.9 V

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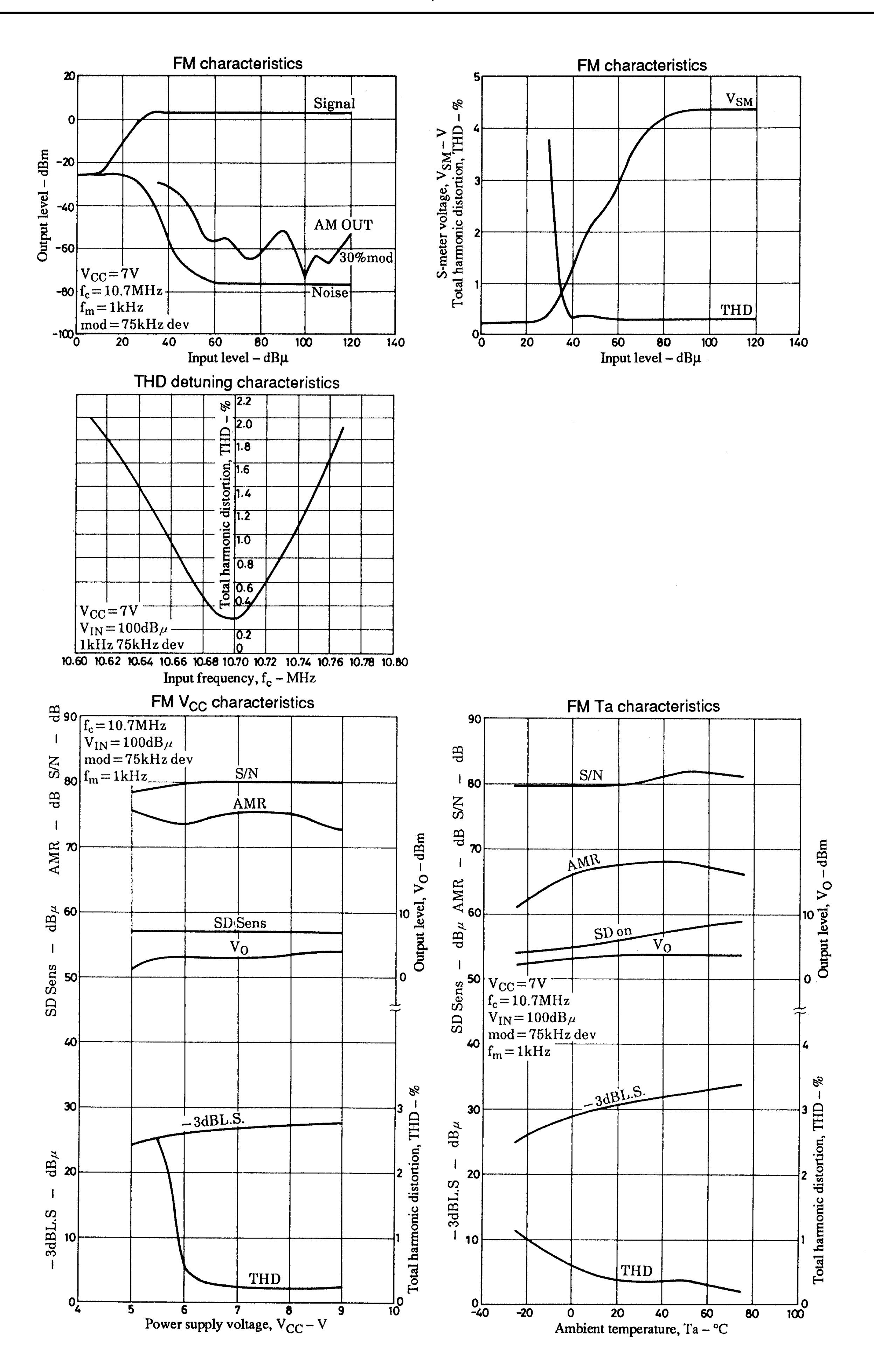
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Pin No.	Function	Voltage	Internal equivalent circuit	Remarks
12	S-meter output, AM SD sensitivity adjustment	0.5 V (FM) 0 V (AM)	12 A01493	The AM SD sensitivity can be adjusted with the resistor between this pin and ground. The AM SD sensitivity should be adjusted first, since the FM SD sensitivity is affected by this adjustment.
13	AM narrow band CF connection	1.5 V	13 A01494	Recommended narrow band CF: BFU450C4N (Murata)
14	Phase comparator low-pass filter (FM/AM switch)	V_{CC} – 1.4 (FM) 0 V (AM)	14 A01495	AM mode selected when this pin is connected to ground.
15	Pilot detector low-pass filter (forced mono) (VCO stop)	V_{CC} – 1.0	15 A01496	The circuit is forced to mono when a current of 50 µA or larger flows from this pin. Connecting this pin to ground stops the VCO.
16 17	Post-amplifier L output and R output	V_{REG} V_{REG}	16 (17) A01497	Output impedance r_o = 200 Ω Pin 16: left output Pin 17: right output
18 19	Post-amplifier L input and R input	V_{REG} V_{REG}	18 (19) A01498	Inverting inputs: r_i = 3.3 kΩ Pin 18: left input Pin 19: right input
20 21	MPX output, L output and R output	3.5 V 3.5 V	20 (21) A01499	Output impedance r_o = 3.3 kΩ Pin 20: left de-emphasis Pin 21: right de-emphasis
22	MPX input	2.9 V	22 A01500	Input impedance r_i = 20 kΩ The low-band separation characteristics are improved by increasing the value of the capacitor connected between this pin and pin 24. However, the impulse noise associated with AM/FM switching will increase.

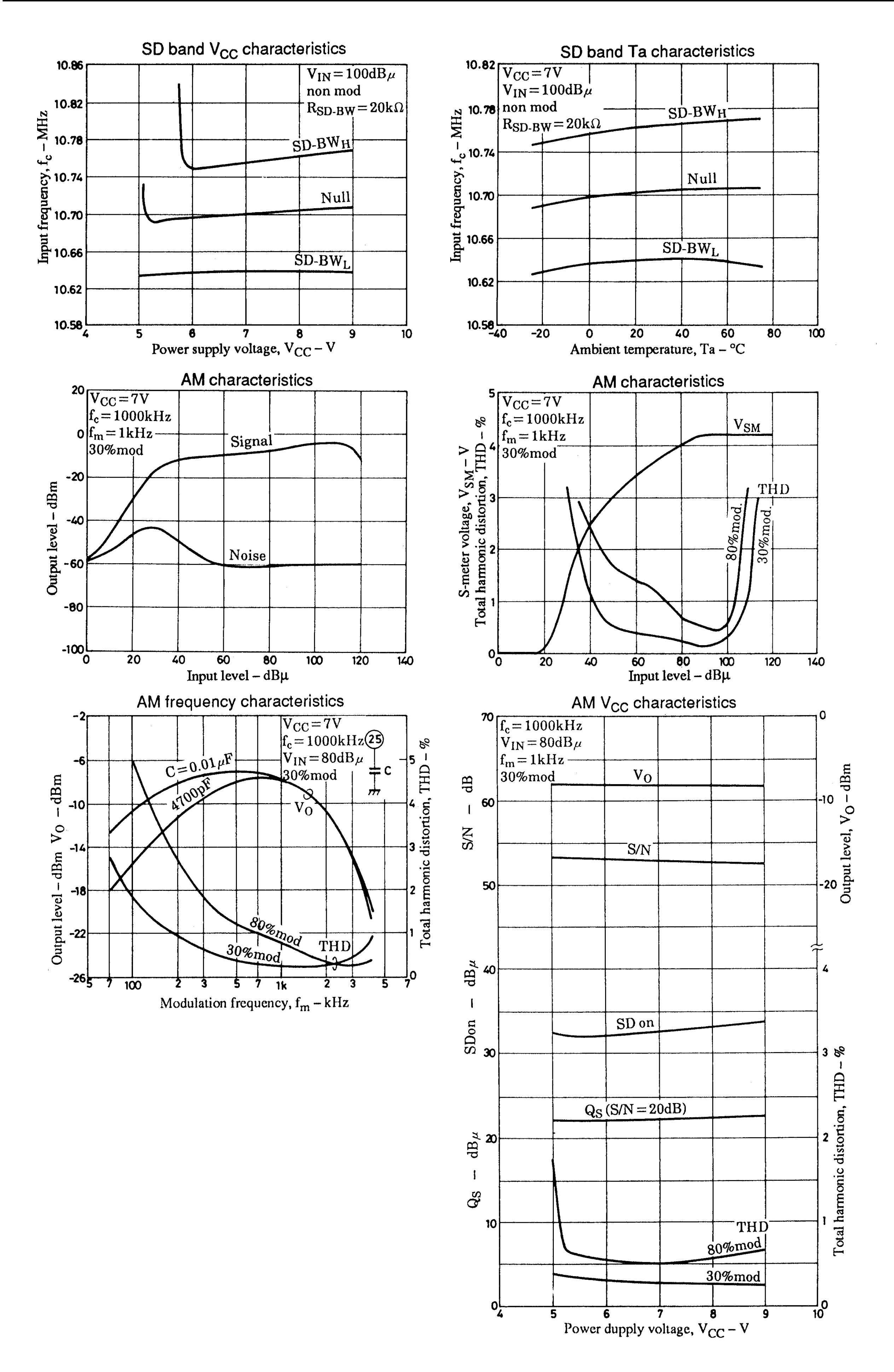
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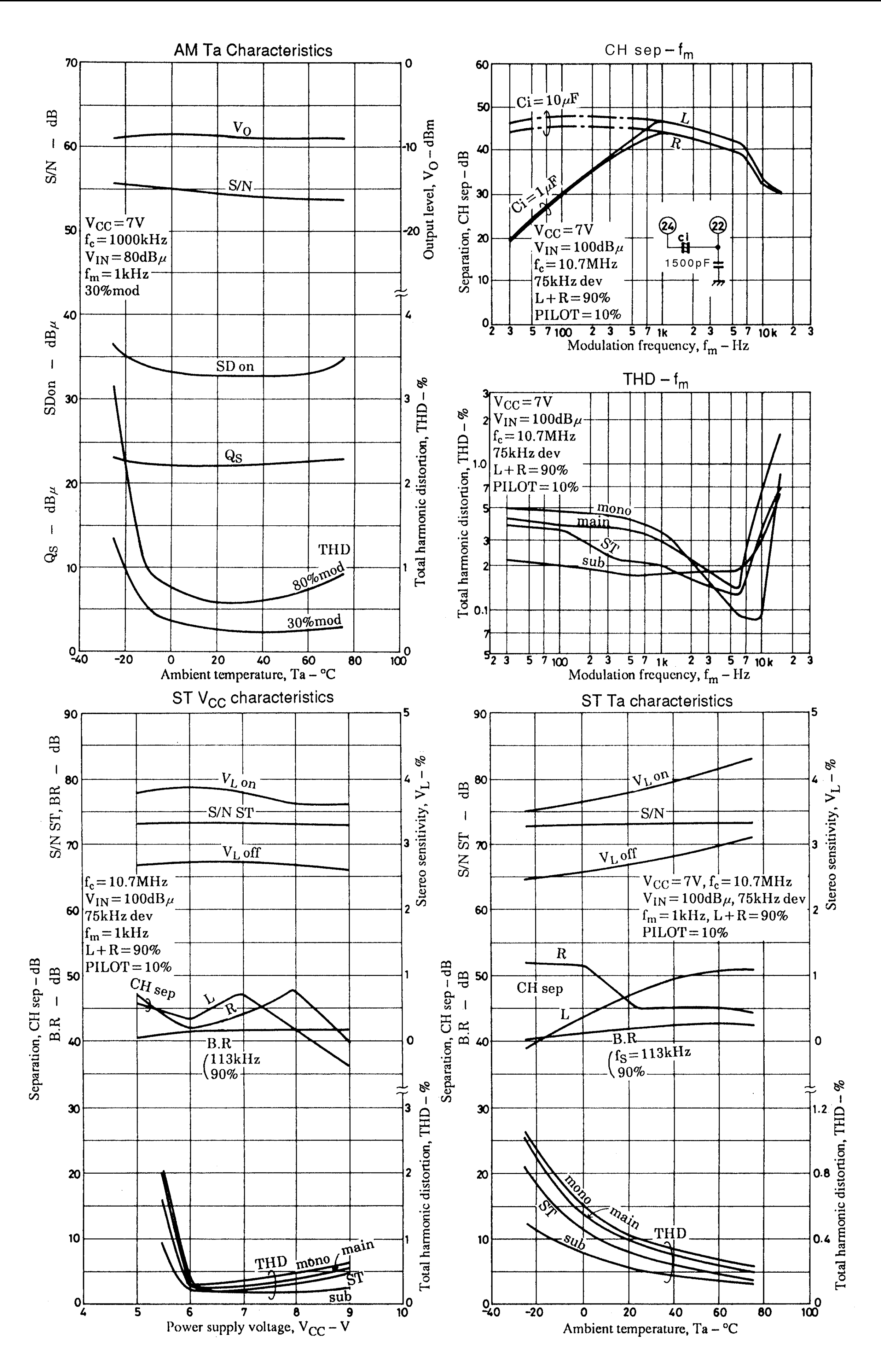
Pin No.	Function	Voltage	Internal equivalent circuit	Remarks
23	MPX VCO	3.5 V (FM) 0 V (AM)	A01501	Recommended ceramic resonator: CSB456F15 (Murata)
24	AM/FM demodulator output	2.9 V (FM) 3.0 V (AM)	A01502	Output impedance: 1.5 kΩ (FM), 10 kΩ (AM) The separation can be adjusted with the external capacitor connected between this pin and ground.
25	AM low cut	2.9 V (FM) 3.0 V (AM)	A01503	The AF demodulation frequency low area frequency characteristics can be adjusted with the external capacitor connected between this pin and ground. The AM detector output can be attenuated by connecting a resistor in series with this capacitor.
26	AM AGC	0 V (FM) 0.5 V (AM)	A01504	Internal load resistance: R = 6.7 kΩ
27	AM RF input	V_{REG}	A02040	This pin must be used at the same potential as pin 4.
28	AFC	V_{REG}	A02041	The FM-SD bandwidth can be adjusted with the external resistor connected between this pin and pin 4.
29	OSC	V_{REG}	A01507	The oscillator coil is connected between this pin and pin 4.
30	Oscillator buffer output, FM SD sensitivity adjustment	1.6 V (FM) 1.3 V (AM)	A01508	The FM SD sensitivity can be adjusted with the external resistor connected between this pin and ground. Output impedance r_o = 200 Ω

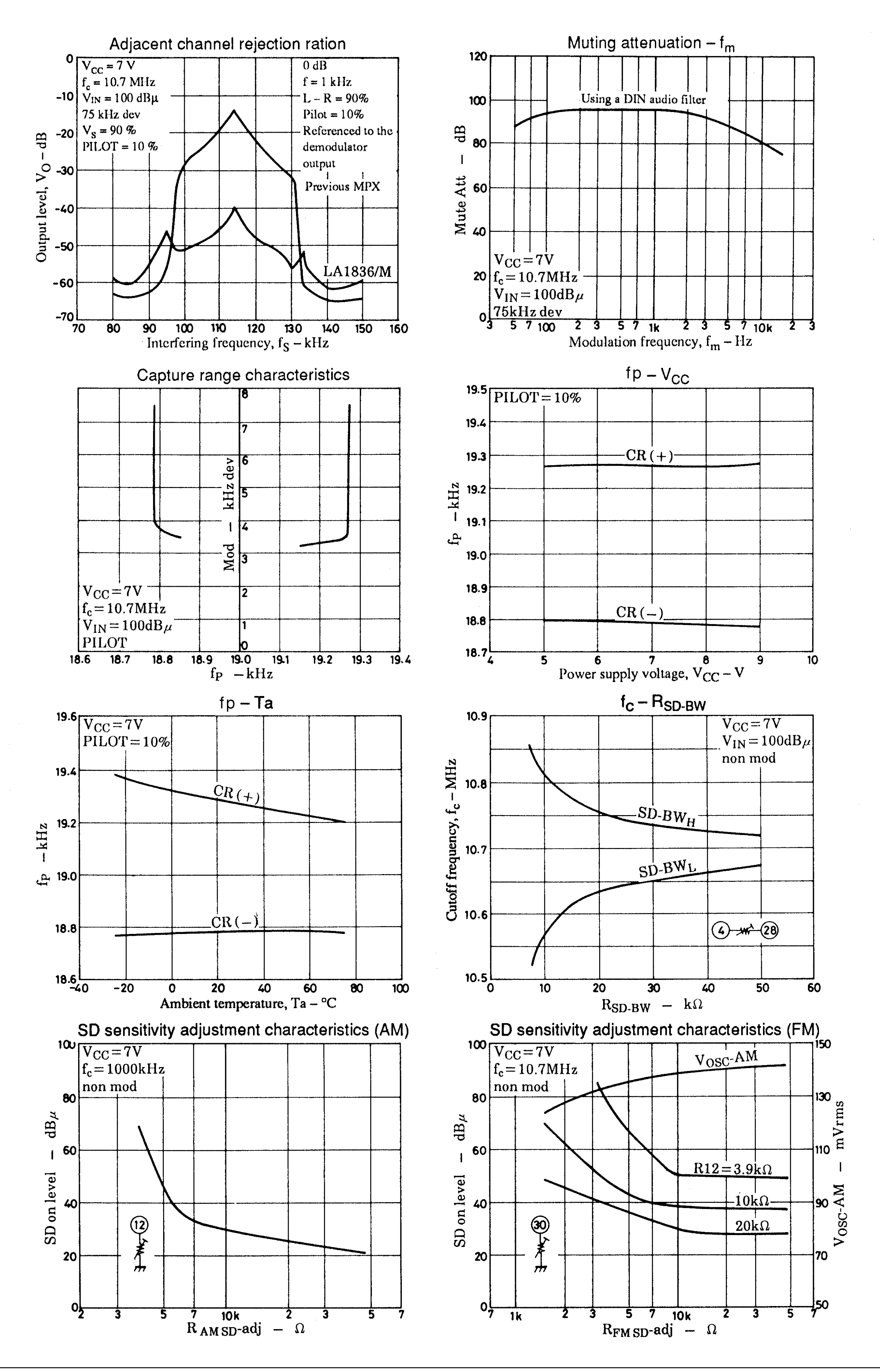


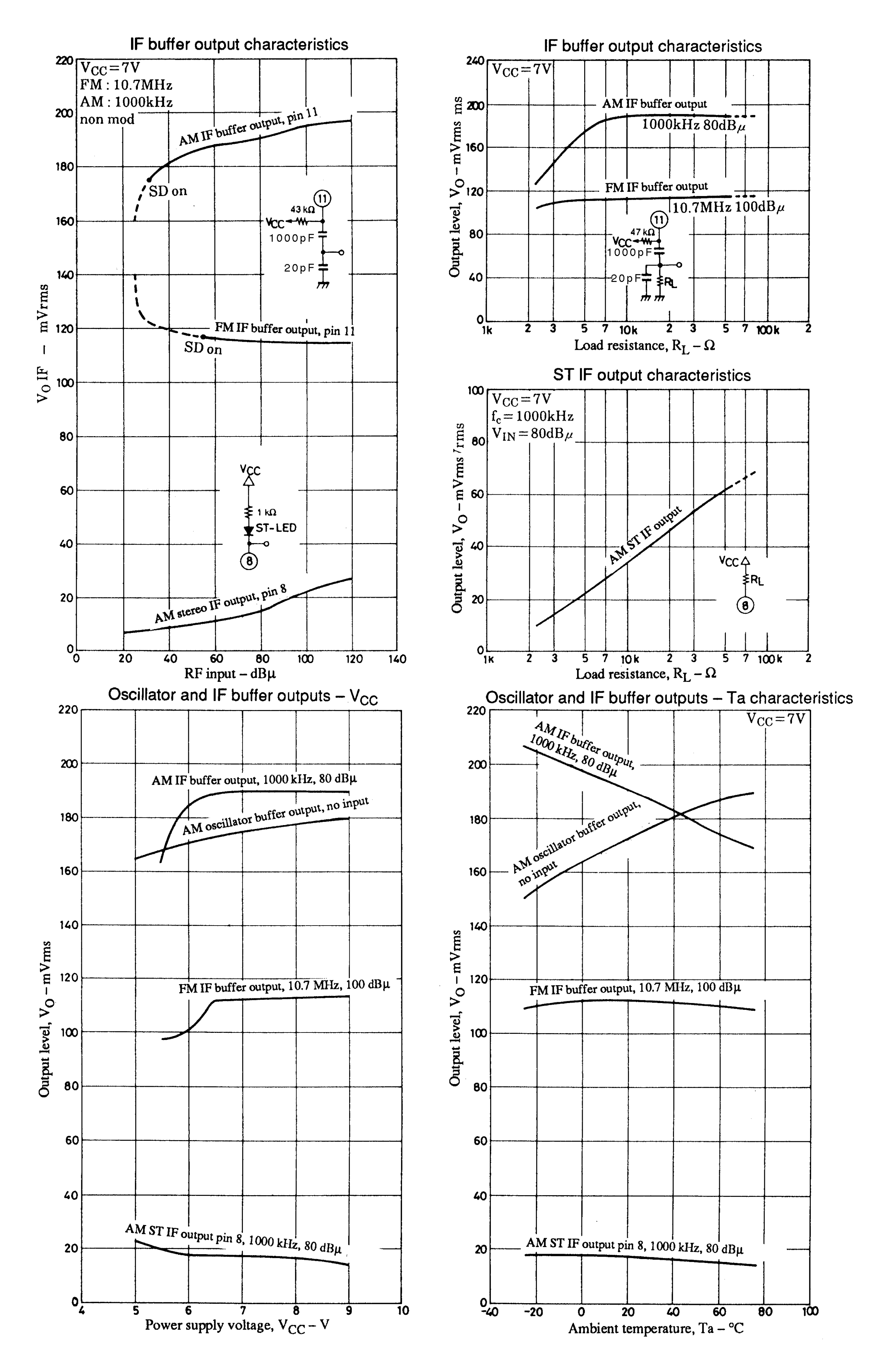
FM characteristics
Signal
AM OUT
30%mod
Noise
VCC=7V
fc=10.7MHz
fm=1kHz
mod=75kHz dev
Output level – dBm
Input level – dBμ
FM characteristics
VSM
THD
S-meter voltage, VSM – V
Total harmonic distortion, THD – %
Input level – dBμ
THD detuning characteristics
Total harmonic distortion, THD – %
VCC=7V
VIN=100dBμ
1kHz 75kHz dev
Input frequency, fc – MHz
FM VCC characteristics
fc=10.7MHz
VIN=100dBμ
mod=75kHz dev
fm=1kHz
S/N
AMR
SD Sens
VO
–3dBL.S.
THD
Power supply voltage, VCC – V
Output level, VO – dBm
Total harmonic distortion, THD – %
FM Ta characteristics
S/N
AMR
SD on
VO
VCC=7V
fc=10.7MHz
VIN=100dBμ
mod=75kHz dev
fm=1kHz
–3dBL.S.
THD
Ambient temperature, Ta – °C
Output level, VO – dBm
Total harmonic distortion, THD – %

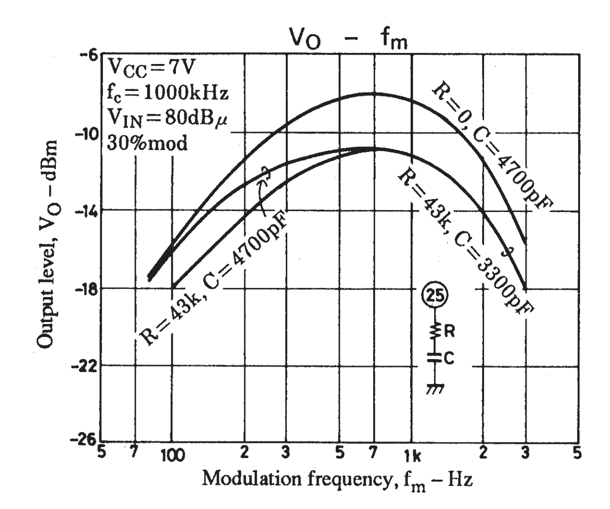


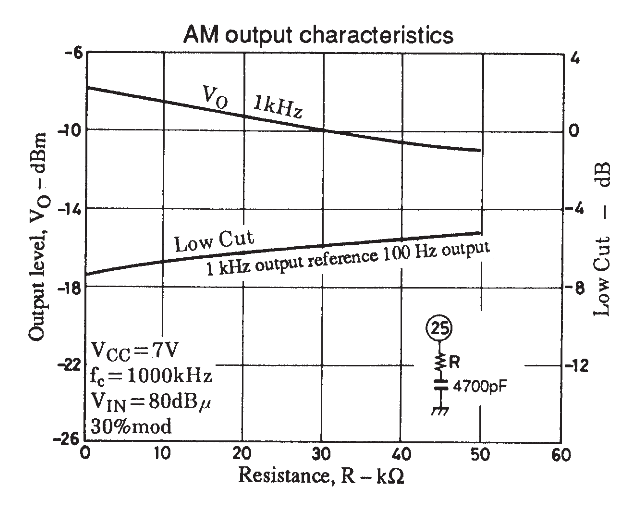
SD band VCC characteristics
VIN=100dBμ
non mod
RSD-BW=20kΩ
SD-BWH
Null
SD-BWL
Input frequency, fc – MHz
Power supply voltage, VCC – V
SD band Ta characteristics
VCC=7V
VIN=100dBμ
non mod
RSD-BW=20kΩ
SD-BWH
Null
SD-BWL
Input frequency, fc – MHz
Ambient temperature, Ta – °C
AM characteristics
VCC=7V
fc=1000kHz
fm=1kHz
30%mod
Signal
Noise
Output level – dBm
Input level – dBμ
AM characteristics
VCC=7V
fc=1000kHz
fm=1kHz
30%mod
VSM
THD
80%mod.
30%mod.
S-meter voltage, VSM – V
Total harmonic distortion, THD – %
Input level – dBμ
AM frequency characteristics
VCC=7V
fc=1000kHz
VIN=80dBμ
30%mod
C=0.01μF
4700pF
VO
80%mod
30%mod
THD
Output level – dBm VO – dBm
Total harmonic distortion, THD – %
Modulation frequency, fm – kHz
AM VCC characteristics
fc=1000kHz
VIN=80dBμ
fm=1kHz
30%mod
VO
S/N
SD on
QS (S/N=20dB)
THD
80%mod
30%mod
S/N – dB
SDon – dBμ
QS – dBμ
Output level, VO – dBm
Total harmonic distortion, THD – %
Power dupply voltage, VCC – V


AM Ta Characteristics
S/N – dB
Output level, V_O – dBm
SDon – dBμ
Q_S – dBμ
Total harmonic distortion, THD – %
V_O
S/N
SD on
Q_S
THD
80%mod
30%mod
V_{CC}=7V
f_c=1000kHz
V_{IN}=80dBμ
f_m=1kHz
30%mod
Ambient temperature, Ta – °C
CH sep – f_m
Separation, CH sep – dB
Ci=10μF
Ci=1μF
L
R
V_{CC}=7V
V_{IN}=100dBμ
f_c=10.7MHz
75kHz dev
L+R=90%
PILOT=10%
1500pF
Modulation frequency, f_m – Hz
THD – f_m
Total harmonic distortion, THD – %
mono
main
ST
sub
ST V_{CC} characteristics
S/N ST, BR – dB
Separation, CH sep – dB
B.R – dB
Stereo sensitivity, V_L – %
V_L on
S/N ST
V_L off
f_c=10.7MHz
V_{IN}=100dBμ
75kHz dev
f_m=1kHz
L+R=90%
PILOT=10%
CH sep
B.R
113kHz
90%
THD
Power supply voltage, V_{CC} – V
ST Ta characteristics
S/N ST – dB
S/N
V_{CC}=7V, f_c=10.7MHz
V_{IN}=100dBμ, 75kHz dev
f_m=1kHz, L+R=90%
f_S=113kHz
Ambient temperature, Ta – °C


Adjacent channel rejection ration
Vcc = 7 V
fc = 10.7 MHz
VIN = 100 dBμ
75 kHz dev
Vs = 90 %
PILOT = 10 %
0 dB
f = 1 kHz
L – R = 90%
Pilot = 10%
Referenced to the demodulator output
Previous MPX
LA1836/M
Output level, VO – dB
Interfering frequency, fS – kHz
Muting attenuation – fm
Using a DIN audio filter
VCC=7V
fc=10.7MHz
VIN=100dBμ
75kHz dev
Mute Att – dB
Modulation frequency, fm – Hz
Capture range characteristics
VCC=7V
fc=10.7MHz
VIN=100dBμ
PILOT
Mod – kHz dev
fP – kHz
fp – VCC
PILOT=10%
CR (+)
CR (–)
fP – kHz
Power supply voltage, VCC – V
fp – Ta
VCC=7V
PILOT=10%
CR (+)
CR (–)
fP – kHz
Ambient temperature, Ta – °C
fc – RSD-BW
VCC=7V
VIN=100dBμ
non mod
SD-BWH
SD-BWL
Cutoff frequency, fc – MHz
RSD-BW – kΩ
SD sensitivity adjustment characteristics (AM)
VCC=7V
fc=1000kHz
non mod
SD on level – dBμ
R AM SD-adj – Ω
SD sensitivity adjustment characteristics (FM)
VCC=7V
fc=10.7MHz
non mod
VOSC-AM
R12=3.9kΩ
10kΩ
20kΩ
SD on level – dBμ
VOSC-AM – mVrms
RFM SD-adj – Ω


IF buffer output characteristics
VCC=7V
FM : 10.7MHz
AM : 1000kHz
non mod
AM IF buffer output, pin 11
SD on
FM IF buffer output, pin 11
SD on
AM stereo IF output, pin 8
VO IF – mVrms
RF input – dBμ
IF buffer output characteristics
AM IF buffer output
1000kHz 80dBμ
FM IF buffer output
10.7MHz 100dBμ
Output level, VO – mVrms
Load resistance, RL – Ω
ST IF output characteristics
fc=1000kHz
VIN=80dBμ
AM ST IF output
Oscillator and IF buffer outputs – VCC
AM IF buffer output, 1000 kHz, 80 dBμ
AM oscillator buffer output, no input
FM IF buffer output, 10.7 MHz, 100 dBμ
AM ST IF output pin 8, 1000 kHz, 80 dBμ
Power supply voltage, VCC – V
Oscillator and IF buffer outputs – Ta characteristics
AM IF buffer output, 1000 kHz, 80 dBμ
AM oscillator buffer output, no input
Ambient temperature, Ta – °C





This catalog provides information as of October, 1997. Specifications and information herein are subject to change without notice.